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Oyster Spatfall In Virginia Waters

❖ *1991 Annual Summary* ❖

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Introduction

The Virginia Institute of Marine Science (VIMS) conducts surveys of oyster spatfall (or "setting") in Virginia waters throughout the summer reproductive period. This survey provides an estimate of the **potential** of a particular area for receiving a "strike" or set of oysters on the bottom and helps define the timing of setting events. Information obtained from this effort is valuable to the Virginia Marine Resources Commission (VMRC) for its shell repletion program, and to private oyster growers, both of which are interested in maximizing the timing of shell planting. In addition, by maintaining a long-term data base, trends in spatfall throughout the lower Chesapeake Bay can be monitored. This in turn provides an index of the general "health" of the Bay.

Bi-weekly updates of spatfall data are provided to interested parties throughout the summer. This report summarizes data collected during the entire 1991 setting season.

Methods

Spatfall in 1991 was monitored from June through September at a total of 40 stations (Figure 1). Throughout these periods shellstrings were deployed 0.5 m off the bottom at each station. A shellstring consisted of 12 oyster shells of similar size (about 3") drilled through the center and strung (inside of shell down) on a piece of heavy gauge wire. Shellstrings were replaced after a one week exposure, and the number of spat that attached to the smooth surface (underside) of the center 10 shells was counted with the aid of a dissecting microscope. This

number was then divided by 10 to get the number of spat per shell for that time interval. A computer program was used to calculate the number of spat per shell per week. These values were interpreted as follows: <0.1, "none"; 0.1-1.0, "light"; 1.1-10.0, "moderate"; and >10.1, "heavy."

Weekly sampling allowed setting trends over the course of the summer to be compared between the various locations. Comparisons of setting intensity between years were made by adding the weekly values of spat per shell for the entire setting season.

Results

Weekly spat/shell values and annual spatfall totals (sums of weekly values) are given in Table I.

❖ *James River*

Twelve stations were monitored in the James River. Spat settlement began the week of June 15 and continued at five of the stations through the week of September 21. "Moderate" spatfall was seen from the week of June 15 through the week of August 24. "Heavy" spatfall occurred at Nansemond Ridge the week of July 20, Naseway Shoal from June 29 through the week of August 10, Dog Shoal and Days Point from July 6 through the week of August 10, at Dry Shoal from June 22 through the week of August 10, and at Swash the weeks of July 27 and August 3.

For the year, spatfall totals ranged from 10.8 spat/shell at Deepwater Shoal to 274.8 spat/shell at at Dog Shoal. Dog Shoal and Naseway Shoal and Dry Shoal and Days Point were the two areas that received the greatest spatfall. Most spatfall in the James River occurred in July and the first half of August.

❖ *Mobjack Bay*

Spat settlement was followed at five locations in Mobjack Bay. Setting began at three stations the

week of June 1 and continued through the week of September 21. "Moderate" setting began at East River the week of June 15, but as late as the week of July 13 at Wilson Creek. "Heavy" spatfall occurred at Brown's Bay the week of July 20 and at Pepper Creek for three weeks beginning July 6.

Over the course of the setting season, spatfall was highest at Pepper Creek (70.1 spat/shell) and lowest at Wilson Creek (12.1 spat/shell). Most spat settlement took place in July.

❖ *York River*

The VIMS oyster pier was the only shellstring station located on the York River. Settlement began the week of June 8 and continued through the week of August 10. "Moderate" setting occurred from July 13 through the week of July 27 and "heavy" settlement was seen the week of July 20.

Total spatfall for the year was 18.7 spat/shell, most of which occurred in July.

❖ *Piankatank River*

Spatfall was seen at all four stations in the Piankatank River beginning the week of June 22 and continuing into September at three of the stations. Settlement was "moderate" at all locations from the end

of June through the week of August 3 (Burton Point), August 17 (Three Branches), August 24 (Ginney Point) and August 31 (Palace Bar). No "heavy" spatfall was seen in the Piankatank River in 1991.

For the year, spatfall ranged from 16.3 spat/shell at Burton Point to 39.1 spat/shell at Palace Bar, spread relatively evenly throughout the summer.

❖ *Great Wicomico River*

Six stations were monitored in the Great Wicomico River. Spat settlement was first seen at Dameron Marsh the week of June 15 and continued at all stations through the week of September 21. "Moderate" settlement occurred at all stations for at least one week and up to three weeks, but at different times. No "heavy" spatfall was recorded.

Total spatfall for the year was lowest at Glebe Point (3.8 spat/shell) and greatest at Haynie Point (13.6 spat/shell). Spatfall in the Great Wicomico River was fairly continuous throughout the summer with no well defined peak period.

❖ *Little Wicomico River*

Settling at P.G. 42 in the Little Wicomico River began the week of June 29

and continued through the week of September 14. "Moderate" spatfall occurred the week of July 27 and was "light" the remainder of the summer. No "heavy" spatfall was recorded.

For the entire setting season, spatfall was 4.8 spat/shell, over half of which occurred in July.

❖ *Rappahannock River*

Spatfall began at the three stations monitored in the Rappahannock River the week of June 22 and continued into September. "Moderate" settlement occurred from June 22 through the week of July 27 at Sturgeon Creek and Locklies Creek and the week of August 17 at Windmill Point. "Heavy" spatfall was not seen in the Rappahannock River in 1991.

Yearly spatfall totals ranged from 12.7 spat/shell at Sturgeon Creek to 25.5 spat/shell at Locklies Creek. Settlement in the Rappahannock River was most concentrated from late June to early August.

❖ *Potomac River*

Settlement in the Potomac River began as early as the week of June 15 and extended as late as the week of September 28. Four of the six stations, however, had only "light"

settlement during this period. At Jones Shore, "moderate" settlement was seen the weeks of July 20 and 27. At Cornfield, "moderate" and "heavy" settlement occurred from July 20 through the week of August 10.

Spatfall totals for the year ranged from 0.3 spat/shell at Coan River to 50.5 spat/shell at Cornfield. At Cornfield, settlement was greatest the last week in July and the first week in August.

❖ *Eastern Shore*

Three stations were monitored for spatfall on the seaside of the Eastern Shore. Spatfall generally extended from late June through at least mid-September. At all three locations, "moderate" spatfall began June 29. At Wachapreague, "heavy" settlement began July 20 and continued through the week of August 24. In Hog Island Bay, settlement was "heavy" the weeks of July 13 and 20, and again the week of August 3 at Hog Island North.

For the year, spatfall totals were 287.4 spat/shell at Wachapreague, 109.7 spat/shell at Hog Island North, and 67.4 spat/shell at Hog Island South. At Wachapreague, most settlement occurred in July and August; in Hog Island Bay, most settlement occurred in July.

Discussion

Overall, spatfall potential in Virginia was slightly greater in 1991 than in 1990 (Table II). Of the 39 locations for which comparisons could be made, 22 had greater spat/shell totals in 1991 than in 1990. General trends in spatfall tended to be river specific, however. For example, spatfall totals were greater in 1991 than 1990 in the James River, the Potomac River, the York River, and on the Eastern Shore. Spatfall totals were lower in 1991 than 1990 in Mobjack Bay, the Piankatank River, the Little Wicomico River, and the Great Wicomico River.

The areas having the greatest likelihood for recruitment in 1991 based on the shellstring survey were:

1. James River -
Naseway Shoal, Dog Shoal, Swash, Nansemond Ridge, Dry Shoal and Days Point
2. Mobjack Bay - Pepper Creek, Brown's Bay and East River
3. Piankatank River -
Palace Bar and Ginney Point
4. Great Wicomico River -
Hudnall's Dock, Haynie Point, and Cranes Creek
5. Rappahannock River -
Locklies Creek and Windmill Point
6. Eastern Shore -
Wachapreague and Hog Island Bay

As previously mentioned, spatfall on shellstrings is an indicator of relative numbers of larvae

(ready to set) in a particular location at a particular time. Subsequent spat settlement and survival on nearby shoal areas is variable and dependent on a number of factors. High spat counts on shellstrings may not be accompanied by a good set on bottom shell if it is not plentiful or clean enough to attract the metamorphosing larvae. Conversely, for unknown reasons, good setting on bottom shell may occur even though setting on shellstrings was light. It is not known what level of setting on shellstrings is indicative of good setting on bottom cultch, if conditions on the bottom are optimal. Also, it is not known whether recruitment is more readily effected by continuous, light setting or intense setting of short duration.

Subsequent survival of oysters that do set on the bottom is controlled to a great extent by environmental conditions, predators, and disease. Results from the shellstring surveys are reflective of the abundance of oyster larvae present in an area, and thus an indication of reproductive activity and the **potential** for recruitment, depending on prevailing conditions.

Spat/shell totals for 1991 were generally lower than the long-term average. Spatfall totals in 1991 were lower than the running (up to 10 year) means at 24 of 40 stations where comparisons were possible

(Table II). The areas that exceeded the long term average, however, were in the James River (most notably Dog Shoal and Dry Shoal), Locklies Creek in the Rappahannock River, Cornfield Harbor in the Potomac River, and all three stations on the Eastern Shore. Thus in spite of an overall downward trend, some areas had good recruitment potential in 1991.

The general decline in spatfall that has occurred in Virginia in recent years can be attributed to several potential causes. First of all, there are fewer adult oysters available for reproduction. The oyster diseases MSX and *Perkinsus* have caused widespread mortality in many areas of the state since 1959, particularly in the higher salinity (lower) portions of the rivers. Even though MSX has been eliminated from many areas due to a recent return to "normal" rainfall and salinity, *Perkinsus* continues to be prevalent and cause mortality. In areas such as the upper James River where disease has caused less oyster mortality than other areas, harvesting pressure — by selectively removing larger oysters — may be having the same effect.

1990 is the fourth year in a row that spat/shell totals in the upper James River (Point of Shoals, Horsehead, Deepwater Shoal) have been below the 10 year average. Secondly, a decline in overall water quality can reduce the reproductive capability of oysters and affect larval survival. The extent to which a reduction in water quality is affecting oyster recruitment, however, is difficult to quantify.



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SHELLSTRING SURVEY STATIONS

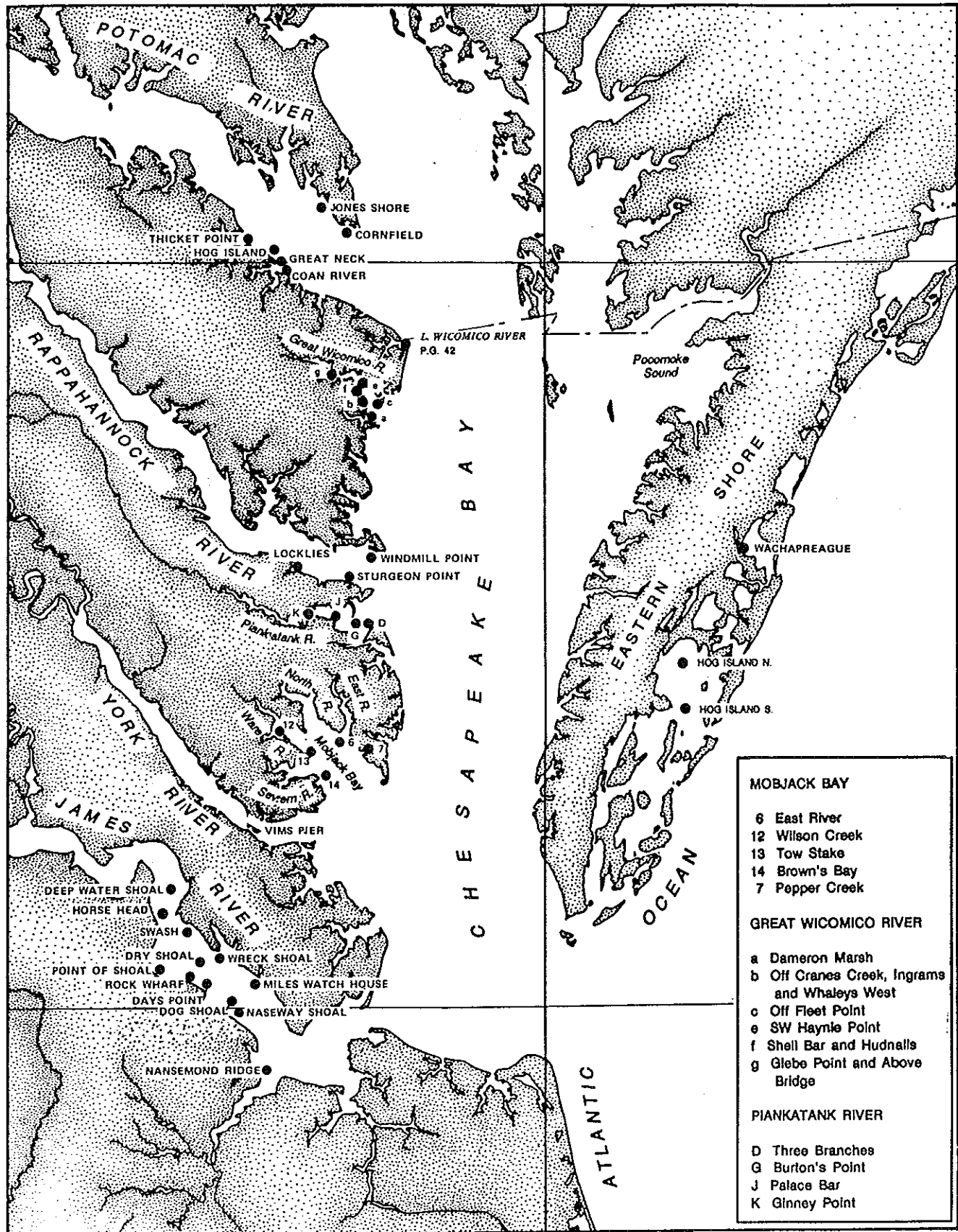


Figure 1. Location of shellstring stations.

TABLE I

Average number of spat/shell (10 shells) for a 7 day period starting with the date shown.
 (--- indicates that no data was obtained for the week)

Week of:	June					July					August					September				October		Total
	1	8	15	22	29	6	13	20	27	3	10	17	24	31	7	14	21	28	5	12		
JAMES RIVER																						
Nansemond Rdg.	0.0	0.0	---	1.1	1.1	3.4	8.8	13.2	9.5	7.1	6.8	4.0	0.9	0.5	0.0	<0.1	0.1	0.0			56.5	
Naseway Shoal	0.0	0.0	1.5	4.0	12.9	16.6	40.5	55.5	16.0	17.1	12.1	2.1	0.4	0.3	0.0	0.0	0.0	0.0			179.0	
Dog Shoal	0.0	0.0	1.2	4.6	8.1	11.5	32.9	44.5	33.5	69.4	63.0	4.1	1.4	0.5	0.0	0.0	<0.1	0.1			274.8	
Miles W. H.	0.0	0.0	0.1	0.5	0.9	3.3	4.4	2.4	3.1	1.8	1.2	0.6	0.2	0.2	0.0	---	0.0	0.0			18.7	
Days Point	0.0	0.0	1.0	4.5	9.2	10.1	10.3	13.0	17.4	35.9	35.3	7.2	1.0	---	1.0	0.6	0.1	0.0			146.6	
Wreck Shoal	0.0	0.0	0.4	1.4	2.0	5.4	6.7	3.4	4.5	5.2	4.7	1.4	0.3	0.0	0.0	0.0	0.0	0.0			35.4	
Dry Shoal	0.0	0.0	0.9	11.6	17.2	22.5	35.8	25.0	26.9	36.2	29.7	8.9	1.6	0.8	0.1	0.0	0.0	0.0			217.2	
Pt. of Shoals	0.0	0.0	0.0	0.6	0.8	0.8	1.7	2.2	3.3	4.7	4.6	1.8	0.5	0.1	0.2	0.1	0.0	0.0			21.4	
Swash	0.0	0.0	0.3	2.2	3.5	4.7	5.9	9.4	16.0	13.1	9.1	3.7	0.2	0.0	0.1	0.2	0.2	0.0			68.6	
Horsehead	0.0	0.0	0.2	1.0	1.3	2.2	2.6	2.8	4.6	3.6	4.0	1.8	0.3	0.2	0.0	0.0	0.0	0.0			24.6	
Deepwater	0.0	0.0	0.2	0.6	0.8	0.7	0.8	2.2	2.9	0.9	0.6	0.5	0.1	0.0	0.1	0.2	0.1	0.1			10.8	
MOBJACK BAY																						
Brown's Bay	0.0	0.1	0.2	1.1	3.1	5.6	7.2	12.3	7.3	1.6	0.4	0.1	0.1	0.2	0.4	0.3	0.2	0.0			40.2	
Tow Stake	0.6	0.2	0.0	0.1	0.2	3.0	3.1	2.4	3.8	1.4	0.1	0.1	<0.1	0.0	0.7	0.3	0.1	0.0			16.1	
Wilson Creek	0.4	0.5	0.1	0.0	0.0	0.6	2.5	1.4	4.1	1.9	0.1	0.0	<0.1	0.1	0.3	0.1	0.0	0.0			12.1	
East River	0.6	0.2	1.1	0.7	1.0	7.9	6.2	5.8	4.4	2.0	0.8	0.2	0.1	0.2	0.1	0.4	0.3	0.0			32.0	
Pepper Creek	0.0	0.0	0.1	0.2	2.3	17.7	21.4	13.7	8.5	3.2	1.6	0.8	0.2	0.0	0.3	0.1	<0.1	0.0			70.1	

TABLE I, Page 2

Week of:	June					July					August					September				October		Total
	1	8	15	22	29	6	13	20	27	3	10	17	24	31	7	14	21	28	5	12		
YORK RIVER																						
VIMS Pier	0.0	0.1	0.3	0.3	0.6	0.7	4.4	10.1	1.8	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0		18.7		
PIANKATANK RIVER																						
Three Branches	0.0	0.0	0.0	0.5	1.7	2.0	1.6	1.7	3.9	3.0	3.5	1.3	0.4	0.0	<0.1	0.1	---	---		19.7		
Burton Point	0.0	0.0	0.0	0.3	1.3	2.3	2.4	1.1	2.6	3.2	0.9	0.9	0.1	0.4	0.2	0.6	0.0	0.0		16.3		
Palace Bar	0.0	0.0	0.1	2.3	6.9	4.4	1.6	1.1	3.4	7.5	1.7	4.0	3.9	1.1	0.2	0.4	0.5	0.0		39.1		
Ginney Point	0.0	0.0	0.0	0.5	2.2	3.5	2.0	1.4	1.2	2.9	3.0	5.7	2.2	0.6	0.0	0.0	0.0	0.0		25.2		
GREAT WICOMICO RIVER																						
Dameron Marsh	---	0.0	0.2	0.2	0.2	0.8	0.7	0.2	3.2	4.4	0.2	0.0	0.1	0.2	0.2	0.3	0.1	0.0	0.0	11.0		
Cranes Creek	---	0.0	0.0	0.2	0.3	1.7	1.5	0.8	1.0	0.5	1.0	1.9	1.2	0.3	0.2	0.1	<0.1	0.0	0.0	10.7		
Hudnall's Dock	---	0.0	0.0	1.5	1.5	1.4	0.6	0.2	0.4	0.2	0.2	0.5	0.1	0.1	0.1	0.1	0.1	0.0	0.0	7.0		
Haynie Point	---	0.0	0.0	0.3	0.6	1.3	0.9	0.5	4.1	4.9	0.3	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1	13.6		
Glebe Point	---	0.0	0.0	0.0	---	---	0.4	0.4	---	0.0	0.5	1.1	0.7	0.3	0.3	0.1	<0.1	0.0	0.0	3.8		
Fleeton Point	---	0.0	0.0	1.5	2.7	1.4	0.2	0.0	2.2	1.3	<0.1	0.1	0.2	0.3	0.2	0.0	0.0	0.0	0.0	10.1		
LITTLE WICOMICO RIVER																						
P.G. No. 42	0.0	0.0	0.0	0.0	0.1	<0.1	0.3	0.8	1.8	0.7	0.2	0.1	0.0	0.4	0.3	0.1	0.0	0.0		4.8		

TABLE I, Page 3

Week of:	June					July					August					September				October		Total
	1	8	15	22	29	6	13	20	27	3	10	17	24	31	7	14	21	28	5	12		
RAPPAHANNOCK RIVER																						
Sturgeon Creek	--	0.0	0.0	1.3	1.1	1.2	2.5	2.1	1.4	0.9	0.9	0.7	0.3	0.2	0.1	0.0	0.0	0.0			12.7	
Locklies Creek	--	0.0	0.0	2.0	3.0	5.6	7.4	1.4	2.2	1.0	1.0	1.0	0.6	0.1	<0.1	0.1	0.1	0.0			25.5	
Windmill Point	--	0.0	0.0	1.0	2.4	2.8	3.4	3.5	2.7	1.9	1.9	1.4	0.5	1.0	0.9	0.0	0.0	0.0			23.4	
POTOMAC RIVER																						
Jones Shore	0.0	0.0	0.0	0.1	<0.1	0.4	0.4	1.1	1.8	0.6	0.0	0.2	1.7	1.4	0.5	0.0	0.0	0.0	0.0		8.2	
Hog Island	0.0	0.0	0.1	<0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.1	<0.1	0.0	0.0	0.0	0.0		0.4	
Coan River	0.0	0.0	0.0	0.0	0.1	0.1	<0.1	0.0	0.0	0.0	0.0	0.1	<0.1	0.0	0.0	0.0	0.0	0.0	0.0		0.3	
Great Neck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.4	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0		1.1	
Thicket Point	0.0	0.0	0.0	0.0	0.0	0.0	0.1	<0.1	0.2	0.2	0.0	0.1	0.3	0.3	0.1	0.1	<0.1	0.0	0.0		1.4	
Cornfield	0.0	0.0	0.0	0.1	0.1	0.0	0.7	5.6	24.8	16.4	1.8	0.1	0.2	0.4	0.1	0.1	0.1	<0.1	0.0		50.5	
EASTERN SHORE																						
Wachapreague	0.1	0.1	<0.1	0.3	2.4	3.4	7.9	69.7	55.8	40.1	29.1	29.5	16.1	8.5	15.1	7.7	1.4	0.2	0.0		287.4	
Hog Island No.	--	0.0	0.0	0.1	2.6	4.8	14.3	50.4	8.8	15.2	5.4	3.4	2.3	0.5	1.2	0.7	0.0	0.0			109.7	
Hog Island So.	--	0.0	0.0	0.0	1.0	2.8	11.7	21.3	5.3	5.5	4.6	5.1	7.5	0.5	1.9	0.2	0.0	0.0			67.4	

TABLE II

Spat/shell totals for years 1980-1990 (when available) and running mean (up to 10 years);
 (+ or - indicates relationship of 1991 total to 1990 total and running mean;
 - - indicates an absence of data for that year)

Location	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	Running Mean	1991 (+/-, +/-)
JAMES RIVER												
Nansemond Ridge	31.7	19.7	46.7	15.1	69.7	8.8	18.4	8.9	26.0	40.6	28.6	56.5 (+, +)
Naseway Shoal	313.0	81.0	224.7	41.0	465.9	40.0	296.6	18.5	59.4	20.6	156.1	179.0 (+, +)
Dog Shoal	--	--	--	38.3	568.8	32.1	356.9	27.5	73.0	34.4	161.6	274.8 (+, +)
Miles W.H.	21.3	18.5	46.8	16.7	20.9	9.8	33.7	3.2	4.2	2.4	17.8	18.7 (+, +)
Days Point	--	--	--	24.4	120.3	22.3	481.6	17.3	25.9	28.6	102.9	146.6 (+, +)
Rock Wharf	--	--	--	38.7	163.5	11.4	285.7	40.9	3.5	17.1	80.1	--
Wreck Shoal	51.9	36.7	104.8	21.2	26.3	7.9	35.1	10.0	10.5	5.9	31.0	35.4 (+, +)
Dry Shoal	--	--	--	24.0	87.1	16.8	241.5	13.2	10.1	45.8	62.6	217.2 (+, +)
Point of Shoals	74.3	18.1	77.4	23.5	31.2	4.6	75.4	9.9	2.1	2.9	31.9	21.4 (+, -)
Swash	87.6	55.6	333.8	37.2	38.1	9.2	79.5	7.6	3.8	3.9	65.6	68.6 (+, +)
Horsehead	71.9	16.3	96.6	28.1	36.0	7.3	100.0	3.7	1.5	1.0	36.2	24.6 (+, -)
Deepwater Shoal	74.3	18.1	77.4	23.5	31.2	4.6	75.4	9.9	2.1	3.8	32.0	10.8 (+, -)
MOBJACK BAY												
Brown's Bay	10.8	36.0	71.1	4.6	7.1	241.1	8.0	2.2	29.9	44.7	45.6	40.2 (-, -)
Tow Stake	94.0	61.2	18.8	14.3	2.5	15.7	1.9	5.3	28.8	64.7	30.7	16.1 (-, -)
Wilson Creek	177.3	27.5	11.0	39.3	1.7	5.7	2.6	4.8	42.8	101.9	41.5	12.1 (-, -)
East River	99.3	33.3	26.8	14.1	9.4	29.2	8.9	13.1	37.8	64.0	33.6	32.0 (-, -)
Pepper Creek	20.6	46.1	87.5	18.3	112.5	264.6	40.7	4.7	18.0	74.2	68.7	70.1 (-, +)

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	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	Running Mean	1991 (+/-, +/-)
YORK RIVER												
VIMS Pier	6.7	16.0	6.2	2.2	20.5	165.2	25.0	7.1	5.4	14.4	27.0	18.7 (+, -)
PIANKATANK RIVER												
Three Branches	36.2	45.0	27.2	17.6	- -	97.9	64.9*	1.7	22.5	55.7	41.0	19.7 (-, -)
Burton Point	34.6	23.3	27.1	38.8	85.7	252.8	43.9*	4.7	31.6	102.1	64.5	16.3 (-, -)
Palace Bar	76.8	59.4	146.2	59.7	124.5	376.5	243.9*	9.1	42.3	139.9	127.8	39.1 (-, -)
Ginney Point	34.5	60.0	171.7	126.6	82.7	204.2	133.3*	5.6	30.0	85.6	93.4	25.2 (-, -)
GREAT WICOMICO RIVER												
Dameron Marsh	3.3	30.2	12.7	0.9	8.6	43.3	29.1	59.3	6.1	29.2	22.3	11.0 (-, -)
Cranes Creek	5.7	54.1	6.7	1.3	6.3	121.6	30.5	17.4	11.7	39.1	29.4	10.7 (-, -)
Hudnall's Dock	31.6	122.9	16.3	3.3	14.2	237.6	50.8	61.8	28.4	119.6	68.6	7.0 (-, -)
Haynie Point	25.9	74.9	12.9	0.7	7.6	170.8	10.5	57.4	20.1	67.9	44.9	13.6 (-, -)
Glebe Point	296.8	364.5	0.6	2.2	10.9	364.6	23.6	27.1	9.1	19.8	111.9	3.8 (-, -)
Fleeton Point	2.3	50.8	42.7	1.7	78.4	42.8	157.9	10.1	9.0	18.1	41.4	10.1 (-, -)
LITTLE WICOMICO RIVER												
P.G. No. 42	- -	- -	- -	- -	- -	- -	- -	- -	0.2	5.2	2.7	4.8 (-, +)

TABLE II, Page 3

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	Running Mean	1991 (+/-, +/-)
RAPPAHANNOCK RIVER												
Sturgeon Creek	--	--	--	--	--	21.6*	1.1	1.7	1.7	--	6.5	12.7 (+)
Locklies Creek	--	--	--	--	--	27.7	2.8	3.3	2.4	4.6	8.2	25.5 (+, +)
Windmill Point	--	--	--	--	--	--	45.9	1.4	1.0	98.5	36.7	23.4 (-, -)
POTOMAC RIVER												
Jones Shore	15.4	381.1	14.5	0.7	20.6	16.2	27.2	3.8	0.1	0.4	48.0	8.2 (+, -)
Hog Island	1.7	1.9	1.5	0.3	1.7	4.8	1.8	0.0	0.1	0.2	1.4	0.4 (+, -)
Coan River	0.3	4.2	0.9	0.0	0.0	10.8	0.0	0.4	0.0	0.1	1.7	0.3 (+, -)
Great Neck	0.5	3.1	1.9	0.0	5.2	6.4	1.9	1.4	0.0	0.2	2.1	1.1 (+, -)
Thicket Point	0.9	1.8	1.1	0.1	0.2	5.0	0.3	0.6	0.0	0.2	1.0	1.4 (+, +)
Cornfield	26.6	246.0	22.9	0.2	29.5	3.6	49.6	6.7	1.8	8.9	39.6	50.5 (+, +)
EASTERN SHORE												
Wachapreague	6.9	46.5	121.0	56.4	31.9	66.7	29.7	47.1	144.1	211.4	76.2	287.4 (+, +)
Hog Island N.	--	--	--	--	--	--	--	--	49.9	21.2	35.6	109.7 (+, +)
Hog Island S.	--	--	--	--	--	--	--	--	48.7	14.2	31.4	67.4 (+, +)

* -total is based on less than a full setting season, but is included in running mean

